

US008638549B2

## (12) United States Patent Garelli et al.

### (54) ELECTRONIC DEVICE DISPLAY MODULE

(75) Inventors: Adam T. Garelli, Santa Clara, CA (US);
Dinesh C. Mathew, Fremont, CA (US);
Thomas W. Wilson, Jr., Saratoga, CA
(US); Keith J. Hendren, Capitola, CA
(US); Peteris K. Augenbergs, San
Francisco, CA (US); Brett W. Degner,
Menlo Park, CA (US); Bradley J.
Hamel, Sunnyvale, CA (US); Michael
A. Damlanakis, San Francisco, CA
(US); Patrick Kessler, Mountain View,

CA (US)

(73) Assignee: **Apple Inc.**, Cupertino, CA (US)

(\*) Notice: Subject to any disclaimer, the term of this patent is extended or adjusted under 35

U.S.C. 154(b) by 143 days.

(21) Appl. No.: 12/862,748

(22) Filed: Aug. 24, 2010

(65) Prior Publication Data

US 2012/0050975 A1 Mar. 1, 2012

(51) Int. Cl. *H05K 5/00 H05K 7/00* 

G06F 1/16

(2006.01) (2006.01) (2006.01)

(52) **U.S. Cl.** 

USPC ...... **361/679.27**; 361/679.26; 361/679.55

(58) Field of Classification Search

See application file for complete search history.

### (56) References Cited

## U.S. PATENT DOCUMENTS

2,964,887 A 12/1960 Orozco 3,517,466 A 6/1970 Bouvier

# (10) Patent No.: US 8,638,549 B2 (45) Date of Patent: Jan. 28, 2014

4,766,746		8/1988	Henderson et al.	
5,237,486		8/1993	LaPointe et al.	
5,531,950	4	7/1996	Kimura et al.	
5,606,438	4	2/1997	Margalit et al.	
5,611,517	4	3/1997	Saadi et al.	
5,795,430		8/1998	Beeteson et al.	
5,828,341	4 1	0/1998	Delamater	
5,881,103	4	3/1999	Wong et al.	
		(Continued)		

#### FOREIGN PATENT DOCUMENTS

EP	0683026	3/2001
EP	0911717	3/2003
	(Continued)	

### OTHER PUBLICATIONS

Mathew et al., U.S. Appl. No. 12/483,205, filed Jun. 11, 2009.

(Continued)

Primary Examiner — Anthony Haughton (74) Attorney, Agent, or Firm — Treyz Law Group; G. Victor Treyz; Jennifer Luh

#### (57) ABSTRACT

Electronic devices may have housings. A housing may contain a display on its front face and a rear plate such as a plate formed from glass on its rear face. A peripheral housing member may surround the display and rear plate. An antenna may be formed in the peripheral housing member. The rear plate may be formed from laminated layers including a light guide layer. Device hinges may include hinge structures that are integral to the peripheral housing member. A logo may be formed by coating the rear plate with a patterned masking layer. Display structures for the display and the rear plate may be mounted to opposing sides of a shelf portion of the peripheral housing member. The rear plate may be formed from electrochromic glass and may cover photovoltaic cells and touch sensors. Driver boards may be mounted within a clutch barrel perpendicular to the display.

## 17 Claims, 26 Drawing Sheets



